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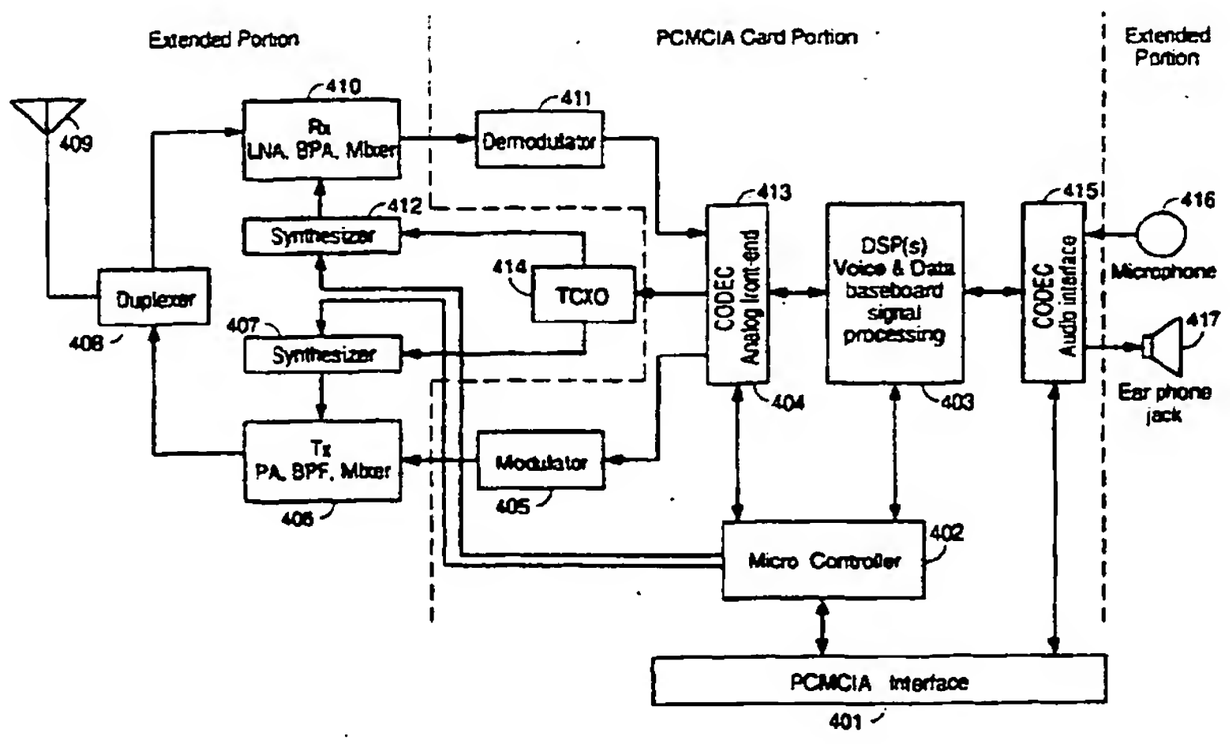


(57) Abstract

A PCMCIA cellular card provides both cellular audio and data communication. Specifically, the PCMCIA cellular card is configured to operate in either a cellular phone handset or in a portable computer. The PCMCIA card includes a baseband portion (403) for providing digital signal processing for both audio and data, an intermediate/radio frequency portion (405, 411) for signal modulation/demodulation and radio signal transmission/receipt, a PCMCIA interface (401) serving as a communicator between the PCMCIA cellular card and the peripheral devices, i.e. the cellular phone handset and the portable computer, and a controller portion (402) for controlling the whole system. Therefore, when an individual travels, the individual is able to either take the cellular phone handset, with the PCMCIA cellular card contained therein (thereby converting the cellular phone handset to a regular cellular phone), or take the portable computer with the PCMCIA communication card installed therein for use with the computer as a modem and a telephone. If an individual takes both the cellular phone handset and the portable computer, only one battery charger is required, thereby saving weight.

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# PCMCIA CELLULAR CARD ADAPTABLE TO A PORTABLE COMPUTER OR A CELLULAR PHONE HANDSET

## BACKGROUND OF THE INVENTION

### Field of the Invention

The present invention relates to a cellular phone, and, in particular to a PCMCIA cellular phone card configured to interface with either a cellular phone handset or a portable computer. Moreover, the present invention relates to a cellular phone handset configured to receive a card (such as a communication card) conforming to PCMCIA standards.

### Discussion of the Related Art

Memory cards, developed in response to the down-sized, internal spacial restrictions of the portable computer, are well known in the art. There are three standard sizes for all memory cards, set by the Personal Computer Memory Card International Association (PCMCIA), namely Type I, Type II, and Type III. All PCMCIA cards measure approximately 55 mm in width and 85 mm in length. However, PCMCIA cards vary in thickness. Specifically, Type I is 3.3mm thick, Type II is 5mm thick, and Type III is 10.5mm thick. Conforming to this PCMCIA standard, internal modem manufacturers have also adopted the size of Type II for internal modems, typically called communication cards. For simplicity, both memory cards and communication cards will be referred to hereinafter as PCMCIA cards.

Figure 1A illustrates a PCMCIA card 100 including a sixty-eight (68) pin socket 101 which is mated to a corresponding plug (not shown) on a circuit board of the

computer. Figure 1B shows an illustrative peripheral socket 103 on PCMCIA card 100. Pin socket 101 is part of the electrical interface complying with PCMCIA standards, whereas peripheral socket 103 corresponds to a variety of plugs not in compliance with PCMCIA standards made by different manufacturers. Other peripheral sockets are described in U.S. Patent No. 5,183,404 which is herein incorporated by reference in its entirety.

Cellular phones are also in common use. Typically, a cellular phone requires a charger for charging the battery in the phone, together with standard telephone circuitry suitable for receiving an audio signal and transmitting that audio signal onto a telephone line through a wireless system. The cellular phone requires a charger to allow the cellular phone battery to be charged directly from the electrical power outlet available in most homes or offices.

A portable computers may include a modem for transmitting information from one place to another. This modem includes the circuitry required to transmit and receive information over the telephone. A portable computer also requires a charger to allow the portable computer batteries to be charged from the electrical power outlet available at homes and offices.

Therefore, a need arises for minimizing the amount of equipment which an individual must carry if the individual is using both a portable cellular phone and a portable computer.

## SUMMARY OF THE INVENTION

In accordance with the present invention, a PCMCIA cellular card provides both cellular audio and data communication. Specifically, the PCMCIA cellular card is configured to operate in either a cellular phone handset or in a portable computer. The PCMCIA cellular card includes a baseband portion for providing digital signal processing for both audio and data, a intermediate/radio

frequency portion for signal modulation/demodulation and radio signal transmission/receipt, a PCMCIA interface serving as a communicator between the PCMCIA cellular card and the peripheral device, i.e. the cellular phone handset or the portable computer, and a controller portion for controlling the whole system.

In this manner, if the PCMCIA cellular card is coupled to an inexpensive cellular phone handset, the card provides the features of a regular portable cellular phone. A cellular phone handset in accordance with the present invention includes an interface to receive a PCMCIA cellular card and a controller such as a micro-controller for controlling the communication between the cellular phone handset and the PCMCIA cellular card. On the other hand, the PCMCIA cellular card includes the circuitry which is typically required in a cellular phone to allow the cellular phone handset to transmit information (both audio and data) and to receive information from another phone.

If the PCMCIA cellular card is coupled to a portable computer or other Personal Digital Assistant (PDA), the card provides a wireless modem capability over the cellular channels for two-way data communication. In one embodiment of the present invention, the PCMCIA cellular card is provided with both an audio pick-up device, such as a microphone, and an ear phone jack. In this embodiment of this invention, the keyboard and display on the portable computer are used as a cellular phone keypad and display to transmit information including the number to be dialed through the PCMCIA cellular card to the receiving station, such as a telephone being dialed. In this manner, the portable computer containing the PCMCIA cellular card functions as a cellular phone as well as a modem. Thus, the present invention allows the portable computer to transmit or receive both audio and data signals. In yet another embodiment of the present

invention, the PCMCIA cellular card includes a telephone answering device for playing back to the listener a received message.

Thus, the present invention provides a flexible, compact system at a substantial savings in cost by reducing the amount of circuitry previously required in a computer to provide a modem and the internal circuitry for a cellular phone. Therefore, when an individual travels, the individual is able to either take the cellular phone handset, with the PCMCIA cellular card contained therein, or take the portable computer with the PCMCIA communication card installed therein for use with the computer as a modem and a telephone.

Furthermore, in accordance with one embodiment of the present invention, one of the two batteries conventionally used to power the portable computer is used to power the cellular phone hand set. In this manner, the present invention also significantly reduces the amount of equipment required to charge batteries carried by an individual who desires to use both a portable computer and a cellular phone.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1A illustrates a conventional pin socket on a PCMCIA card.

Figure 1B shows an illustrative peripheral socket on a PCMCIA card.

Figure 2 illustrates a typical cellular phone system.

Figure 3A shows block diagram of a cellular phone handset in accordance with the present invention.

Figure 3B shows the functional components of a PCMCIA cellular card in accordance with the present invention.

Figure 4 illustrates a block diagram of one embodiment of the PCMCIA cellular card shown in Figure 3B.

Figure 5 shows a portable computer and a cellular phone handset using the same battery.

Figure 6 illustrates a PCMCIA cellular card in accordance with one embodiment of the present invention.

Figure 7 shows a PCMCIA cellular card converting a cellular phone handset to a typical full-function cellular phone.

Figure 8 shows a PCMCIA cellular card providing a typical portable computer with modem and cellular phone capabilities.

## DETAILED DESCRIPTION OF THE DRAWINGS

Referring to Figure 2, a cellular phone system 200 typically includes a transceiver 201 and a control unit 202. Transceiver 201 uses an external antenna 206 to send and receive modulated analog and digital signals from a cellular network 205 via an antenna 207. Transceiver 201, powered by an external power source 203, is coupled to control unit 202 with a plurality of wires 204. Wires 204 transfer both analog information, as typically provided in landline telephones, as well as digital information. This digital information includes, for example, key press, display, and monitoring information required by control unit 202. Control unit 202 typically includes a display 202A, a keypad 202B, a speaker 202C, and a microphone 202D. A more detailed description of a cellular phone system is provided in U.S. Patent No. 4,972,457, and this patent is incorporated herein in its entirety.

Figure 3A shows a block diagram of a cellular phone handset 300 in accordance with the present invention. Referring to Figure 3A, digital signals transmitted through a PCMCIA cellular card interface 311 are coded into analog signals via coding/decoding (CODEC) and logic unit 312. These analog signals are then transmitted to the receiving party via speaker 306.

If a party inputs a telephone number with keypad 305, this keyboard activates driver circuit 304 which in turn transfers the number to microcontroller 301.

Microcontroller 301 controls a driver circuit 302 which in turn operates a liquid crystal display (LCD) 303 to display the transferred number. After receipt of the telephone number, microcontroller 301 activates CODEC/logic unit 312 to decode the digital signals representing the telephone number into DTMF signals heard via speaker 306. Cellular phone handset 300 is powered by power unit 313.

Figure 3B illustrates a simplified block diagram of the functional components of a PCMCIA cellular card 330 in accordance with the present invention. Specifically, PCMCIA cellular card 330 includes a PCMCIA interface 320 which is coupled to a controller/logic unit 323 and a baseband unit 321. Both baseband unit 321 and controller/logic unit 323 are coupled to an intermediate/radio frequency unit 324. Baseband unit 321 is further coupled to external communication unit 325 which includes earphone jack 325A and a microphone 325B.

PCMCIA cellular card interface 320 serves as the communicator between the cellular card and the peripheral device, i.e. the cellular phone handset or the portable computer. Baseband unit 321 provides both audio and data signal processing for PCMCIA cellular card 330. This processing includes speech compression, data compression, and error correction. Baseband unit 321 is compatible with multiple audio and data signal processing standards including, but not limited to, AMPs, IS-54, NMP10, CDPD, and IS-54 rev c. These standards are described in further detail in Appendix I.

Controller/logic unit 323 includes a microcontroller which controls all components in the system, and the logic circuits which provide interconnection of the devices on PCMCIA cellular card 330. The intermediate frequency (IF) unit 324B includes the components to modulate and demodulate the signals. In accordance with this embodiment of the present invention and referring to

Figures 3B and 6, PCMCIA cellular card interface 320, baseband unit 321, controller/logic unit 323, and IF unit 324B are located on portion 601 of PCMCIA cellular card 600 which conforms to PCMCIA cellular card size standards (previously referenced as Type II or Type III).

In accordance with the present invention, components currently not able to conform to these PCMCIA cellular card size standards are placed in portion 602 of PCMCIA cellular card 600. These components include the radio frequency (RF) unit 324A for receiving or transmitting analog signals. The transmitting section of RF unit (Tx) 324A typically includes a power amplifier (PA), a bandpass filter (BPF), a mixer, and a synthesizer. The receiving section of RF unit (Rx) 324A typically includes a low noise amplifier (LNA), as well as a BPF, a mixer, and a synthesizer. Other common components to this unit include a duplexer, and either an internal flat-type antenna or a connector for an external antenna. Portion 602 also houses an internal microphone 603 and a ear phone jack 604 (explained in detail below). With the development of new, i.e. smaller, key components, the components currently contained in portion 602 will be shrunk and included in portion 601. This development is characterized as the path toward the PCMCIA form factor 605.

Figure 4 illustrates a block diagram of one embodiment of the PCMCIA cellular card shown in Figure 3B. Referring to Figure 4, microcontroller 402 receives signals from and sends signals to PCMCIA interface 401. Assume digital signals, for example data signals, are transmitted to PCMCIA cellular card 400 via PCMCIA interface 401. Microcontroller 402 detects these data signals and transfers the signals to the digital signal processing (DSP) unit 403 for data compression, error correction, and other processing. Microcontroller 402 then passes these signals to CODEC unit 413. CODEC unit 413 performs a digital to analog conversion for coding the

digital signals into the appropriate analog signals. To transmit digital signals over audio facilities, these coded signals are converted into signals within the audio frequency range. Modulator 405 provides this conversion function. In one embodiment of the present invention, modulator provides a conventional frequency modulation called FM.

Temperature compensated crystal oscillator 414 provides a stable frequency reference for these signals, whereas synthesizer 407, controlled by microcontroller 402, provides the appropriate channel selection. The mixer of transmitter 406 operates to combine the separate input signals from modulator 405 and synthesizer 407. These combined signals are then consecutively passed through a power amplifier and a bandband pass filter having a single transmission band to duplexer 408. Duplexer 408 allows the processes of transmission and reception to be concurrent.

If the original signals are analog, for example transmitted via microphone 416, CODEC unit 415 digitizes and multiplexes these analog signals and delivers a serial bit stream to digital signal processing (DSP) unit 403. DSP unit 403 performs baseband signal processing, such as audio signal compression, channel coding, and filtering. CODEC unit 413 then converts this bit stream into analog signals. Subsequent processing steps are identical to those described above in reference to digital data signals.

In the receipt mode, antenna 409 receives analog signals and transfers these signals to duplexer 408. Duplexer 408 passes the signals through receiver 410. Once again, temperature compensated crystal oscillator 414 provides a stable frequency reference for these signals, whereas synthesizer 412, controlled by microcontroller 402, provides the appropriate channel selection. The mixer of transmitter 410 operates to combine the separate

input signals from duplexer 408 and synthesizer 412. These combined signals are then consecutively passed through a low noise amplifier and a baseband pass filter having a single transmission band.

Receiver 410 transfers these analog signals to demodulator 411 which demodulates the analog signals. CODEC unit 413 receives the demodulated signals, and then digitizes the information. CODEC unit 413 provides a serial bit stream to digital signal processor 403 for signal processing. Microcontroller 402 determines whether this bit stream is transmitted to another device through PCMCIA interface 401 or is decoded to analog signals with CODEC unit 415 for audio communication via speaker 417.

Figure 5 illustrates one example of a portable computer 500 and a cellular phone handset 501. As shown in Figure 5, portable computer 500 has two batteries 502A and 502B. Typically, cellular phone handset 501 only has one battery 503. In accordance with one embodiment of the present invention, one of the two batteries 502 is placed in cellular phone handset 501. In this manner, the present invention reduces the weight to be carried by the user if the user is carrying both portable computer 500 and cellular phone handset 501. Moreover, in one embodiment of the present invention, the same battery charger is shared by both the dual batteries 502 and battery 503, thereby further reducing the weight carried by the user.

Figure 7 illustrates that a PCMCIA cellular card 700 coupled to an inexpensive cellular phone handset 701, provides the desirable features of a regular portable cellular phone. Figure 8 shows that a PCMCIA cellular card 800 coupled to a portable computer 801 or other Personal Digital Assistant (PDA) provides the functioning of a modem. Moreover, if ear phone 803 is plugged into ear phone jack 804, PCMCIA cellular card 800 provides the functioning of a cellular phone, i.e. the user receiving

the audio signals with ear phone 803 and transmitting audio signals with microphone 805.

Thus, the present invention provides the following advantages:

1. transmitting/receiving of data or placing/ receiving of a telephone call with the computer over the cellular network;

2. receiving and transmitting information, such as wireless electric mail and data files, or programs over the cellular phone;

3. searching and dialing for telephone numbers utilizing any information in the computer such as a computer data base;

4. using power from a computer for audio and data communication;

5. using same phone number both for data and audio communication;

6. using a battery from the portable computer in the cellular phone handset; and

7. having the portable computer and the cellular phone handset share the same battery charger.

While the invention has been described with respect to certain embodiments, the scope of the present invention id defined by the appended claims and is not limited to the embodiments described herein, which are merely illustrative. Accordingly, other embodiments not described herein may be within the scope of the invention as defined by the appended claims.

APPENDIX I

AMPS (Advanced Mobile Phone Service) is a standard for analog cellular telephone system. Frequencies from approximately 824 MHz to 849 MHz are for mobile telephone transmission and 869 MHz to 894 MHz are for transmission from the cellular base stations. AMPS cellular phone system employs FM (frequency modulation) and the channel spacing is 30KHz.

IS-54 is a standard for dual mode cellular telephone system, i.e. TDMA (Time Division Multiple Access) digital cellular phone system and conventional AMPS analog cellular phone system. The TDMA system employs $\pi$/four shifted DQPSK (Differential Quadrature Phase Shift Key) modulation. By using TDMA digital system, the capacity is typically increased three times compared with the AMPS system. The initial release was IS-54 Revision A, whereas the current release is IS-54 Revision B which includes three additional features. These features include: Authentication, Message Encryption, and Voice Privacy. IS-54 Revision C, projected to be released in late 1993 or early 1994, will support data communication.

MNP10 (Microcom Networking Protocol Class 10) is a protocol for circuit switching data communications over analog cellular phone channel.

CDPD (Cellular Digital Packet Data) is a future protocol which supports packet data communication over cellular phone channel.

CLAIMS

We claim:

1. A PCMCIA cellular card comprising:

an interface unit configurable to a plurality of peripheral devices for receiving and transmitting digital signals;

a radio frequency (RF) unit for transmitting and receiving analog signals;

an intermediate frequency (IF) unit for modulation and demodulation of said analog signals;

a baseband unit for processing of said analog and digital signals; and

a control unit for controlling the operation of said interface unit, said RF unit, said IF unit, and said baseband unit.

2. The PCMCIA cellular card of Claim 1 wherein said plurality of peripheral devices includes a cellular phone handset and a portable computer.

3. The PCMCIA cellular card of Claim 2 wherein said interface unit includes a 68 pin socket conforming to PCMCIA standards.

4. The PCMCIA cellular card of Claim 3 wherein said RF unit includes an antenna.

5. The PCMCIA cellular card of Claim 4 wherein said RF unit includes a temperature compensated crystal oscillator for providing a reference signal to said analog signals.

6. The PCMCIA cellular card of Claim 5 wherein said RF unit includes at least one synthesizer for providing a channel selection of said reference signal.

7. The PCMCIA cellular card of Claim 6 wherein said RF unit includes at least one mixer for combining the selected reference signal and said analog signals.

8. The PCMCIA cellular card of Claim 7 wherein said RF unit is located in a first housing.

9. The PCMCIA cellular card of Claim 8 further including an earphone jack and a microphone, said earphone jack and said microphone located in said first housing not conforming to PCMCIA standards.

10. The PCMCIA cellular card of Claim 9 wherein said IF unit includes means for modulating and demodulating said analog signals.

11. The PCMCIA cellular card of Claim 10 wherein said interface unit, said IF unit, said baseband unit, and said control unit are located in a second housing conforming to PCMCIA standards.

12. A cellular phone handset comprising:

an interface to receive a PCMCIA card;

a control unit for displaying and inputting data;

a power unit; and

a structure for controlling the operation of said interface, said control unit, and said power unit.

13. A cellular phone handset comprising:

an interface unit configurable to receive a card conforming to PCMCIA standards.

14. A communications system comprising

a cellular phone handset;

a portable computer;

a PCMCIA cellular card capable of being used in both the cellular phone handset and portable computer, said cellular card containing thereon circuitry for transmitting an audio message over a cellular phone and for transmitting either an audio signal or a digital message from the portable computer when said cellular card is placed in said cellular phone and said computer, respectively.

15. The communications system of Claim 14 wherein said cellular phone handset is charged using a battery from said portable computer.

16. The communications system of Claim 15 wherein said cellular phone handset and said portable computer share a battery charger.

17. A PCMCIA cellular card comprising:

a plurality of components including a transmitter and a receiver, said card being capable of being mounted in either a cellular phone handset or a portable computer, said card including circuitry for transmitting digital and analog signals.

## AMENDED CLAIMS

[received by the International Bureau on 15 November 1994 (15.11.94);
original claims 1, 5, 8-11, 14, 15, 17 amended;
remaining claims unchanged (4 pages)]

1. A PCMCIA cellular card comprising:

an interface unit configurable to a plurality of peripheral devices for receiving and transmitting digital signals;

a radio frequency (RF) unit for transmitting and receiving analog signals;

an intermediate frequency (IF) unit for modulation and demodulation of said analog signals to be transmitted by or received by said radio frequency unit;

a baseband unit for processing of said analog signals to be transmitted by or received by said radio frequency unit and digital signals received by or to be transmitted by said interface unit; and

a control unit for controlling the operation of said interface unit, said RF unit, said IF unit, and said baseband unit.

2. The PCMCIA cellular card of Claim 1 wherein said plurality of peripheral devices includes a cellular phone handset and a portable computer.

3. The PCMCIA cellular card of Claim 2 wherein said interface unit includes a 68 pin socket conforming to PCMCIA standards.

4. The PCMCIA cellular card of Claim 3 wherein said RF unit includes an antenna.

5. The PCMCIA cellular card of Claim 4 wherein said RF unit includes a temperature compensated crystal

oscillator for providing a stable frequency reference signal.

6. The PCMCIA cellular card of Claim 5 wherein said RF unit includes at least one synthesizer for providing a channel selection of said reference signal.

7. The PCMCIA cellular card of Claim 6 wherein said RF unit includes at least one mixer for combining the selected reference signal and said analog signals.

8. A structure including a first portion conforming to PCMCIA standards and a second portion attached to the first portion, the structure comprising:

an interface unit configurable to a plurality of peripheral devices for receiving and transmitting digital signals;

a radio frequency (RF) unit for transmitting and receiving analog signals;

an intermediate frequency (IF) unit for modulation and demodulation of said analog signals to be transmitted by or received by said radio frequency unit;

a baseband unit for processing of said analog signals to be transmitted by or received by said radio frequency unit and digital signals received by or to be transmitted by said interface unit; and

a control unit for controlling the operation of said interface unit, said RF unit, said IF unit, and said baseband unit;

wherein said radio frequency (RF) unit is located in said second portion of said structure.

9. The structure of Claim 8 further comprising an earphone jack and a microphone, said earphone jack and said microphone located in said second portion of said structure.

10. The structure of Claim 9 wherein said IF unit includes means for modulating and demodulating said analog signals.

11. The structure of Claim 10 wherein said interface unit, said intermediate frequency (IF) unit, said baseband unit, and said control unit are located in said first portion conforming to said PCMCIA standards.

12. A cellular phone handset comprising:
an interface to receive a PCMCIA card;
a control unit for displaying and inputting data;
a power unit; and
a structure for controlling the operation of said interface, said control unit, and said power unit.

13. A cellular phone handset comprising:
an interface unit configurable to receive a card conforming to PCMCIA standards.

14. A communications system comprising:
a cellular phone handset;
a portable computer;
a PCMCIA cellular card capable of being used in both the cellular phone handset and portable computer, said cellular card containing thereon circuitry for transmitting an audio signal over a cellular phone and for transmitting either an audio signal or a digital message from the portable

computer when said cellular card is placed in said cellular phone or said computer, respectively.

15. The communications system of Claim 14 wherein said cellular phone handset is powered using a battery from said portable computer.

16. The communications system of Claim 15 wherein said cellular phone handset and said portable computer share a battery charger.

17. A PCMCIA cellular card comprising:

a plurality of components including a transmitter and a receiver, said card being capable of being mounted in either a cellular phone handset or in a portable computer to provide two way audio and data communication.

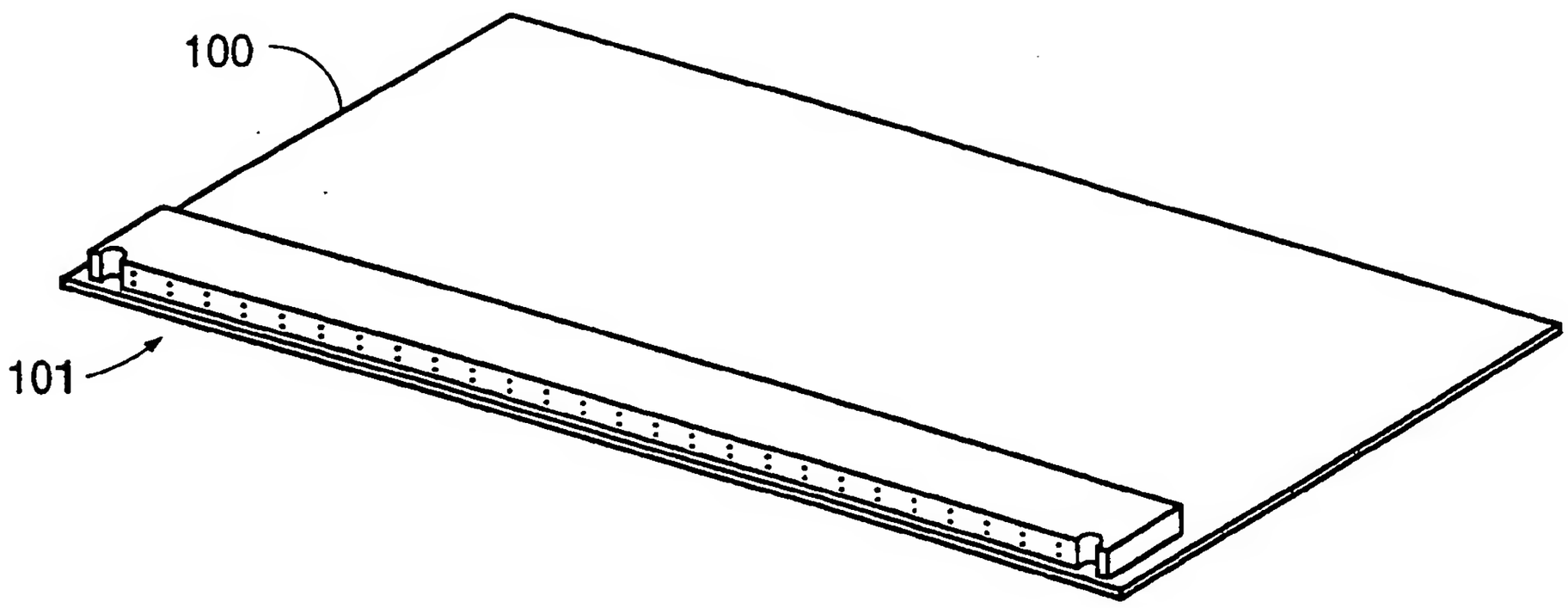



FIG. 1A

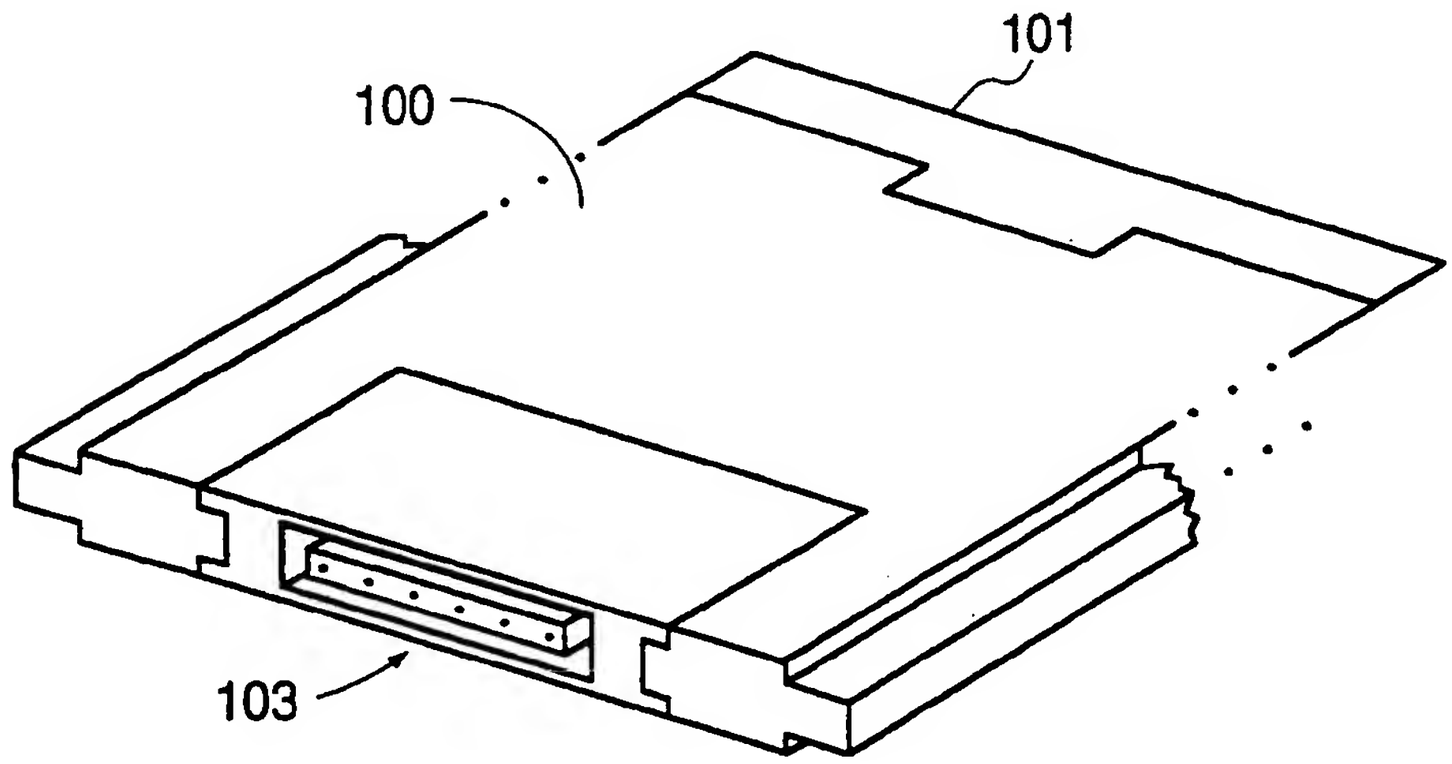



FIG. 1B

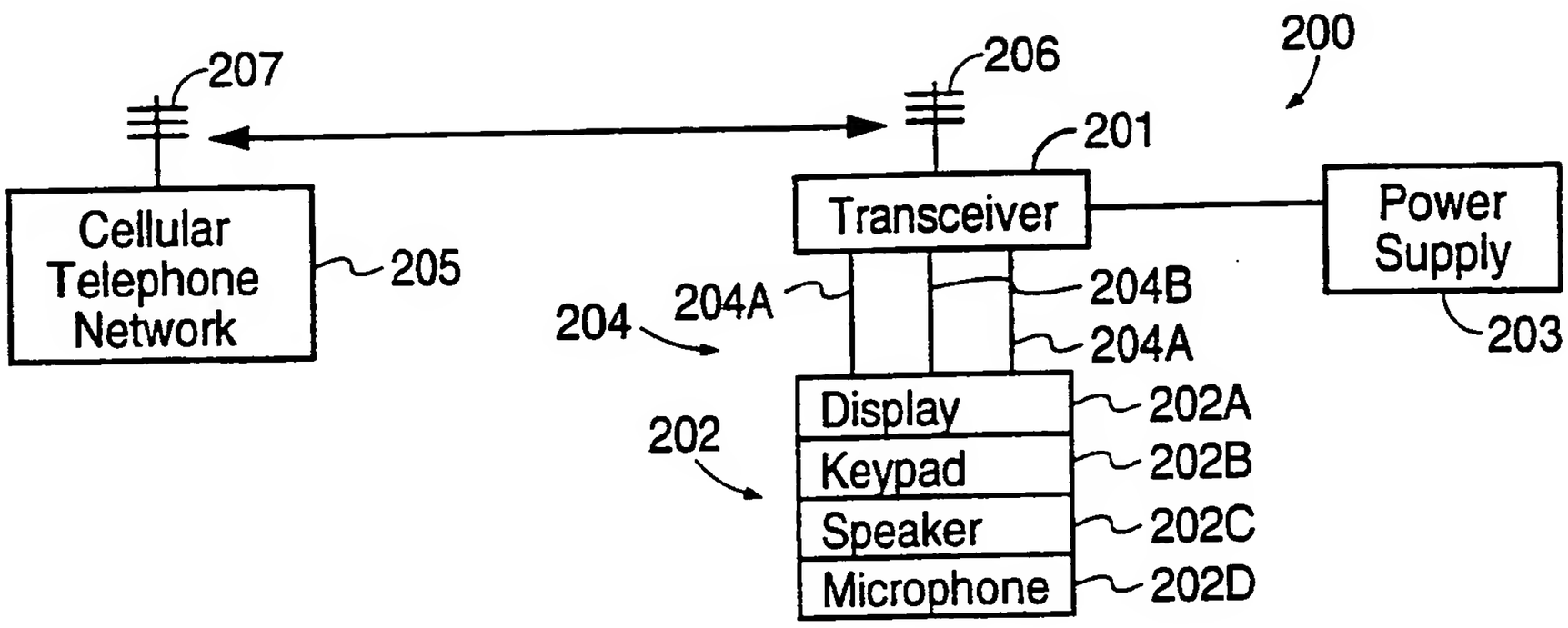

200
207
206
201
Cellular Telephone Network
205
Transceiver
Power Supply
204
204A
204B
204A
203
Display
202A
202
Keypad
202B
Speaker
202C
Microphone
202D

FIG. 2

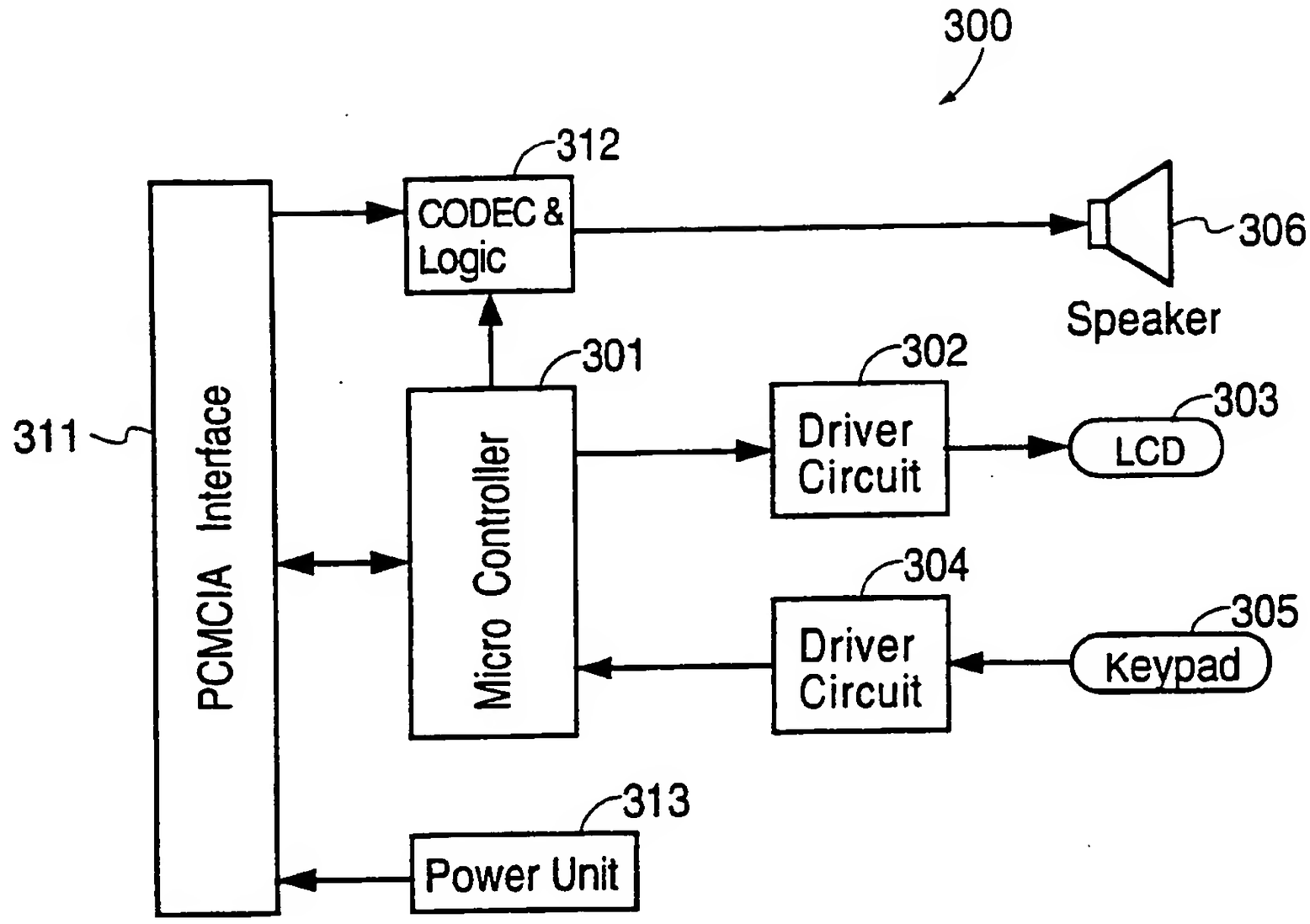

300
312
CODEC & Logic
306
Speaker
311
PCMCIA Interface
301
Micro Controller
302
Driver Circuit
303
LCD
304
Driver Circuit
305
Keypad
313
Power Unit

FIG. 3A

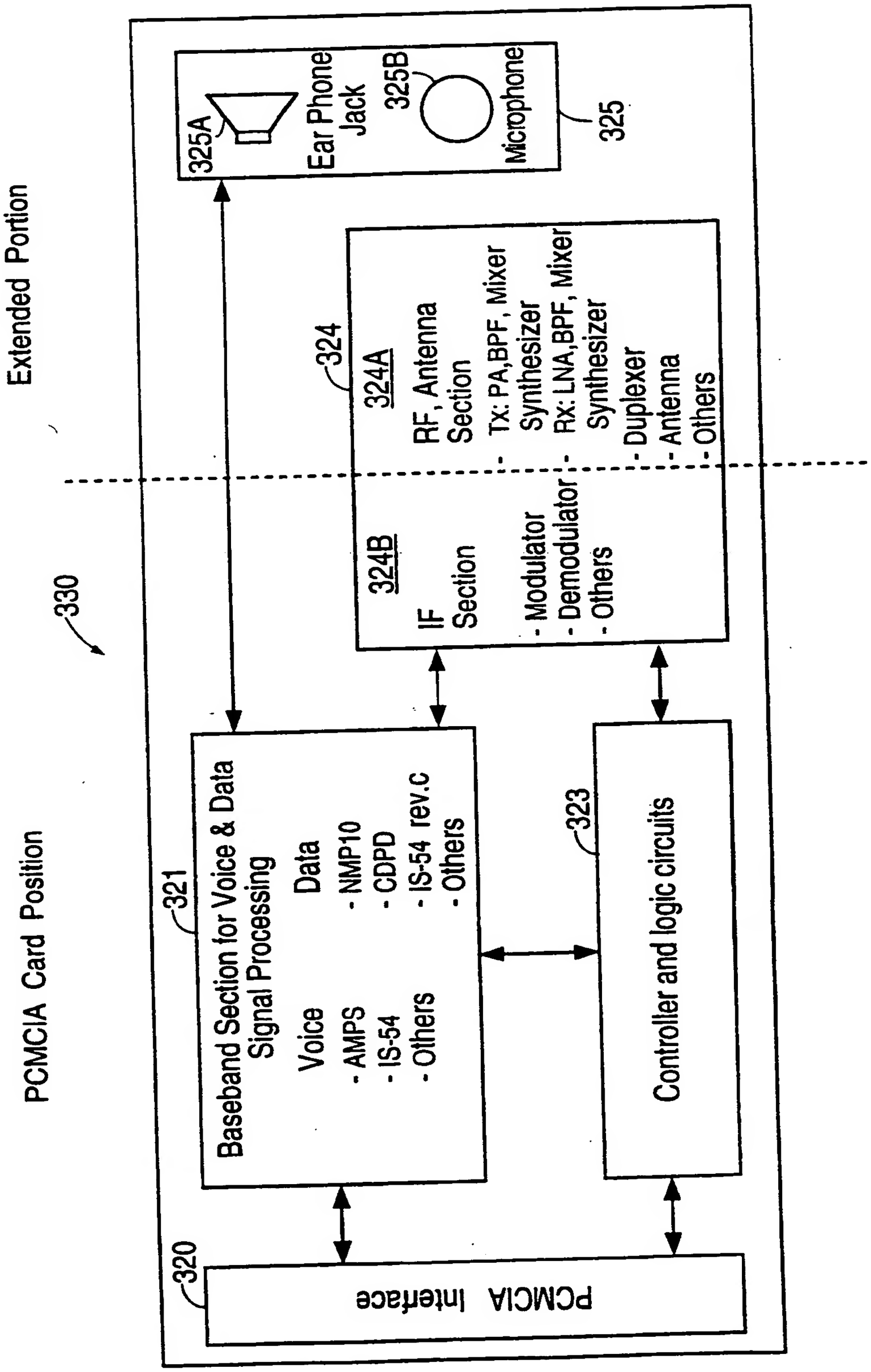

PCMCIA Card Extended Portion
330
325A
Ear Phone Jack
325B
Microphone
325
324
324A
RF, Antenna Section
- Tx: PA,BPF, Mixer Synthesizer
- Rx: LNA,BPF, Mixer Synthesizer
- Duplexer
- Antenna
- Others
324B
IF Section
- Modulator
- Demodulator
- Others
321
Baseband Section for Voice & Data Signal Processing
Voice
- AMPS
- IS-54
- Others
Data
- NMP10
- CDPD
- IS-54 rev.C
- Others
323
Controller and logic circuits
320
PCMCIA Interface

FIG. 3B

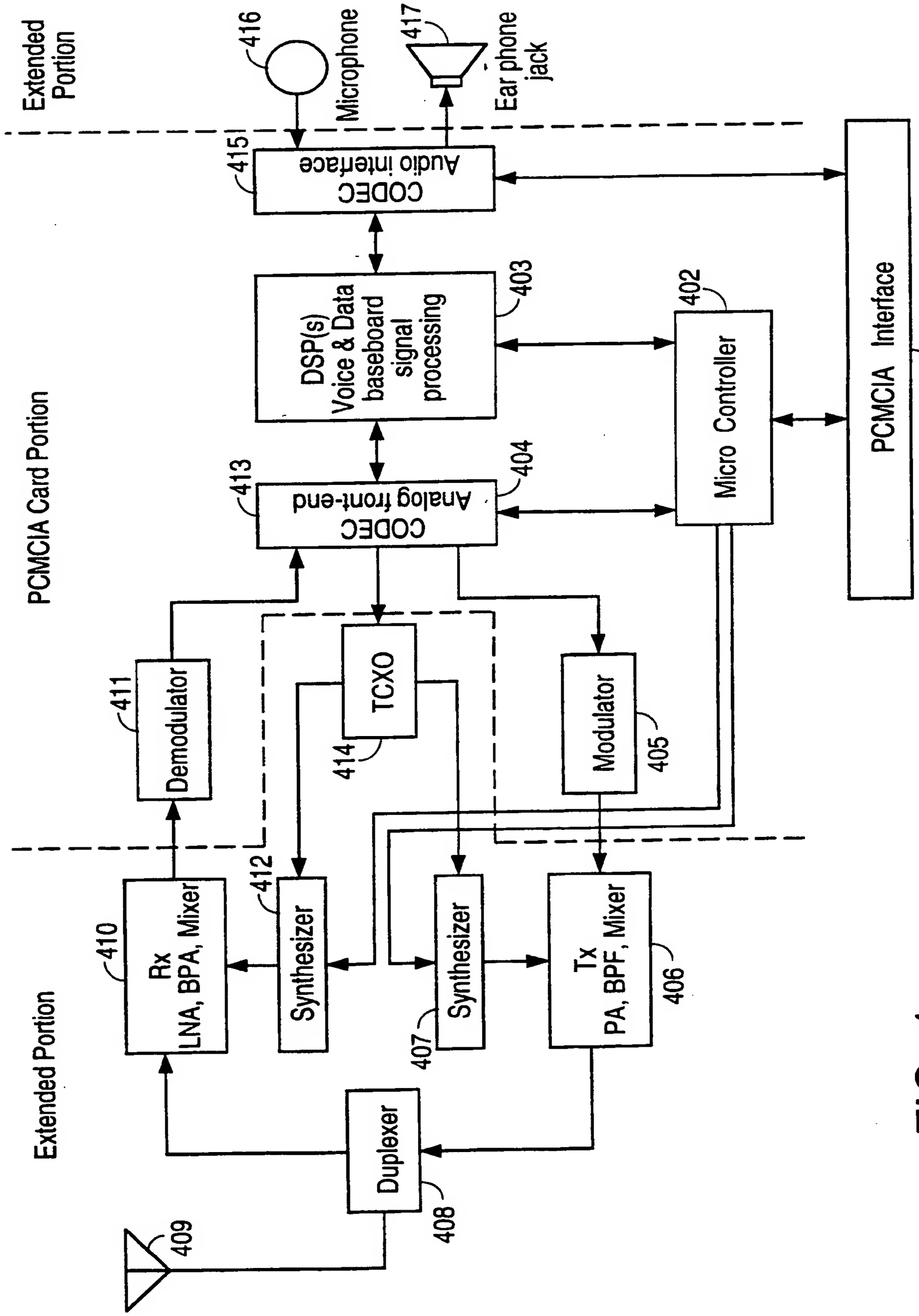

Extended Portion
416
Microphone
417
Ear phone jack
415
Audio interface CODEC
PCMCIA Card Portion
DSP(s) Voice & Data baseboard signal processing
403
402
Micro Controller
PCMCIA Interface
401
413
Analog front-end CODEC
404
411
Demodulator
TCXO
414
Modulator
405
412
Synthesizer
Synthesizer
407
Rx LNA, BPA, Mixer
410
Tx PA, BPF, Mixer
406
Extended Portion
Duplexer
408
409

FIG. 4

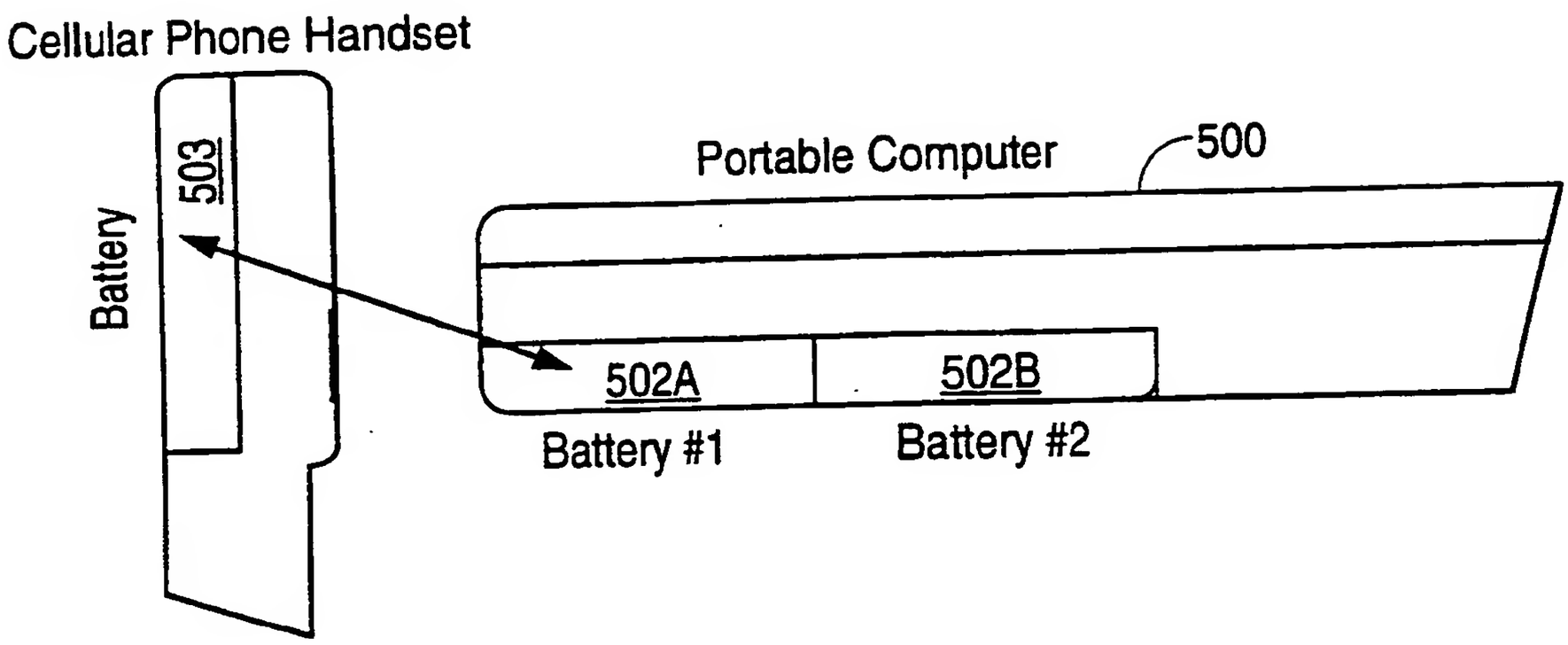

Cellular Phone Handset
503
Battery
Portable Computer
500
502A
502B
Battery #1
Battery #2

FIG. 5

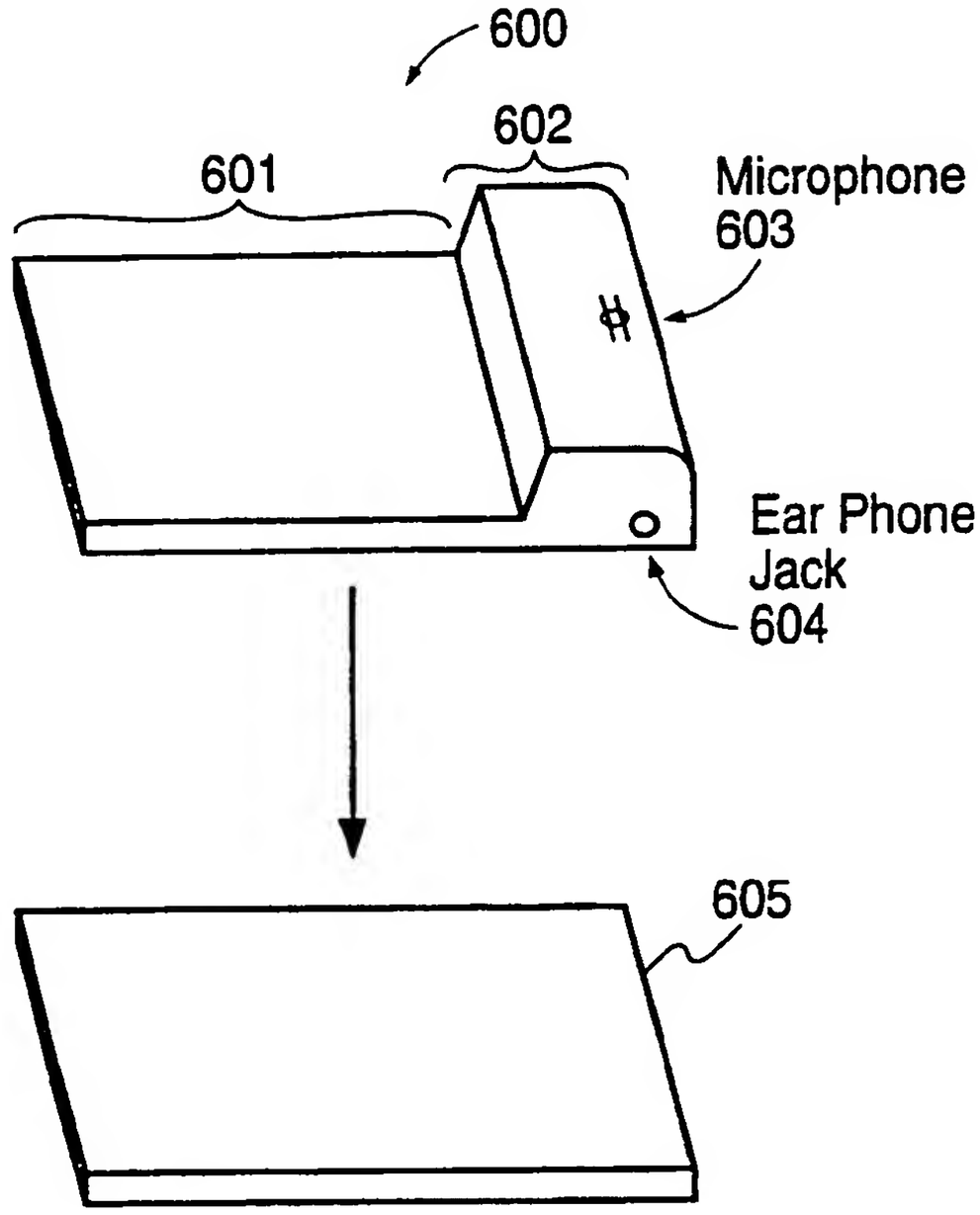



FIG. 6

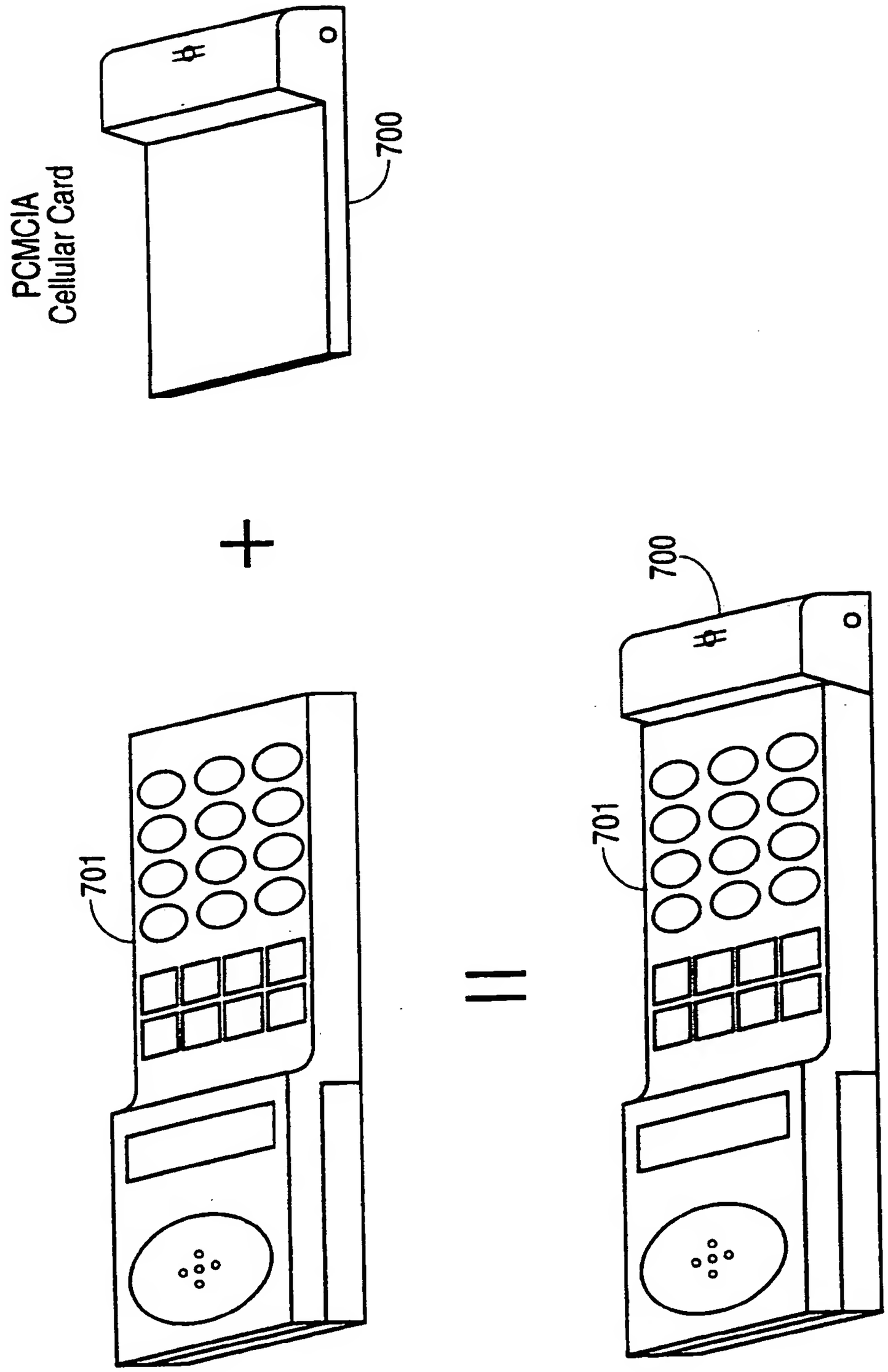
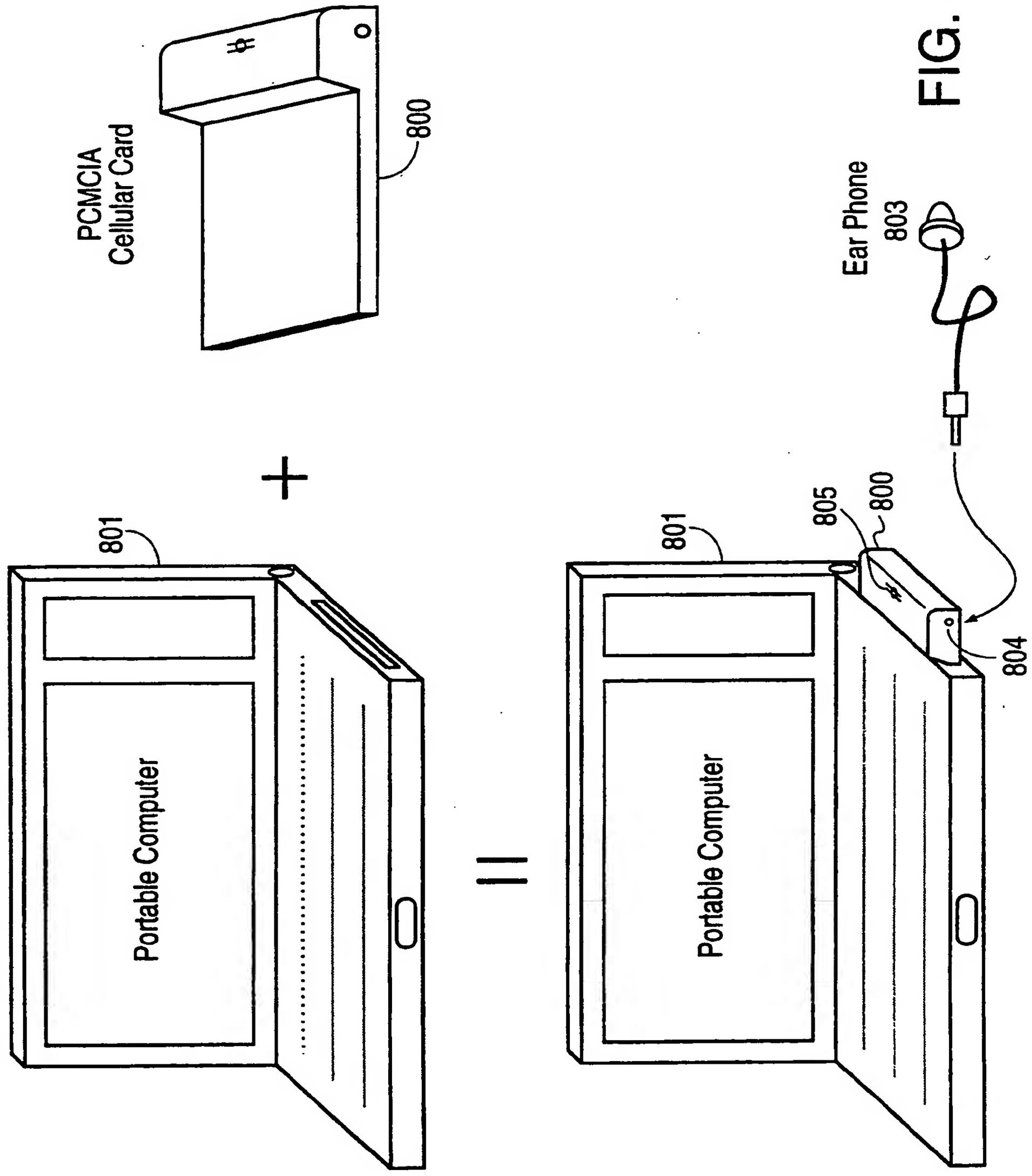



FIG. 7

FIG. 8


PCMCIA
Cellular Card
800
801
Portable Computer
Ear Phone
803
805
804

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/05675

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(5) :H04B 1/38; H04B 1/06
US CL :455/66, 89, 344, 349, 351; 379/ 58, 357

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 455/66, 74, 76, 89, 90, 127, 344-351; 379, 58-63, 357, 429, 441, 442;

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG, APS
search terms: PCMCIA, cellular, mobile, card,

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | US, A, 4,972,457 (O'SULLIVAN) 20 NOVEMBER 1990, SEE COLUMNS 7 AND 8. | 1-17 |
| Y | US, A 5,212,808 (SU ET AL.) 18 MAY 1993, SEE FIGURES 1 AND 3 AND COLUMNS 3-5. | 1-8, 14 AND 17 |
| Y | US, A, 5,099,514, (ACREE) 24 MARCH 1992, SEE ABSTRACT AND COLUMN 1, LINES 6-21. | 9-11 |
| Y | US, A, 5,212,628 (BRADBURY) 18 MAY 1993, SEE ENTIRE DOCUMENT. | 15-16 |
| Y | EDGE:WORK-GROUP COMPUTING REPORT, 18 MAY 1992, "FLASH MEMORY", SEE ENTIRE DOCUMENT. | 1-17 |
| Y | MOBILE DATA REPORT, 27 JULY 1992, "PCMCIA SLATED FOR CELLULAR MOBITEX, PAGING", SEE ENTIRE | 1-17 |

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

| | | | |
|---|---|---|---|
| * | Special categories of cited documents: | "T" | later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
| "A" | document defining the general state of the art which is not considered to be part of particular relevance | "X" | document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone |
| "E" | earlier document published on or after the international filing date | "Y" | document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| "L" | document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | "&" | document member of the same patent family |
| "O" | document referring to an oral disclosure, use, exhibition or other means | | |
| "P" | document published prior to the international filing date but later than the priority date claimed | | |

| | |
|---|---|
| Date of the actual completion of the international search<br>28 JULY 1994 | Date of mailing of the international search report<br>05 OCT 1994 |
| Name and mailing address of the ISA/US<br>Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231<br>Facsimile No. (703) 305-3230 | Authorized officer<br>LISA CHAROUEL<br>Telephone No. (703) 305-4379 |

Form PCT/ISA/210 (second sheet)(July 1992)*